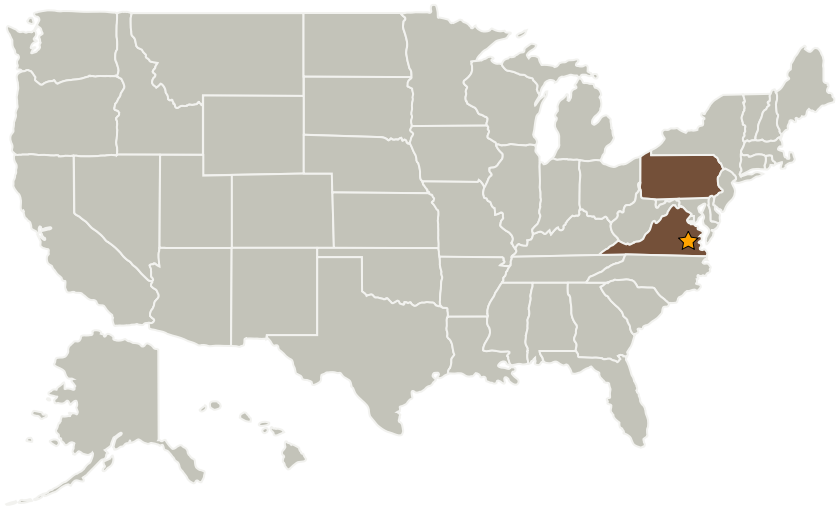
Hybrid Computational Model for High-Altitude Aeroassist Vehicles, Phase I

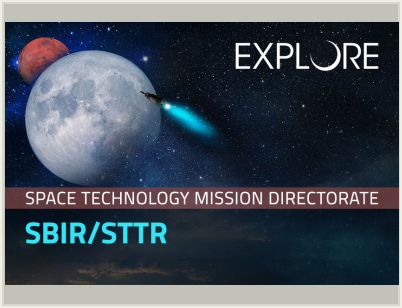
Completed Technology Project (2006 - 2006)

Project Introduction

A hybrid continuum/noncontinuum computational model will be developed for analyzing the aerodynamics and heating on aeroassist vehicles. Unique features of this model include (1) the ability to model rarefied flows with localized continuum features at high altitudes, (2) the ability to model both ablative and non-ablative thermal protection systems, and (3) the ability to model multiple firings of reaction control jets. The model will permit analyzing high-speed, nonequilibrium flows about entry and aeroassist vehicles based on extensions to three-dimensional Navier-Stokes and Direct Simulation Monte Carlo (DSMC) codes. Extension will include effects of liquid and solid particulates along with gaseous species, which should significantly enhance the ability to analyze complex ablation effects. The coupling of these tools to include modeling of multiple reaction-control-jet firings will provide essential data for assessing the aerothermodynamic performance for a wide range of vehicle designs over a wide range of vehicle altitudes and flight conditions. The improved accuracy offered by our proposed hybrid modeling approach offers significant benefits in the design of vehicles for both unmanned planetary missions and manned missions to the Moon and Mars.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
CRAFT Tech - Combustion Research and Flow Technology	Supporting Organization	Industry	Pipersville, Pennsylvania

Primary U.S. Work Locations	
Pennsylvania	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.2 Aerothermodynamics